

ordered late, *i. e.*, after the verifying velocity had begun, one, or 3.00 per cent.

In addition to the above, fifty-five signals were ordered at display stations, the verifications of which it was impracticable to determine.

In twenty-seven instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in twenty-eight instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

#### COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, the verifications of which were determined, twenty; verified, seventeen, or 85.00 per cent. Three signals were ordered, the verifications of which it was impracticable to determine.

#### LOCAL VERIFICATIONS.

The following is from the report of the "Michigan State Weather Service" for May, 1887:

Weather and temperature signals were displayed in one hundred and twelve cities and towns and on the Chicago and Grand Trunk Railway; Detroit, Grand Haven and Milwaukee Railway; Detroit and Port Huron Division Grand Trunk Railway; and the Port Huron and Northwestern Railway. The percentage of verifications was 81.5 on weather, and 77.9 on temperature, predictions. There are many towns ready to display signals after July 1st, when they can be supplied with indications by telegraph.

One cold-wave signal was displayed during the month. The order was re-

ceived at 11.15 a. m. of the 2d, and the minima temperatures in the state on the morning of the 4th were from 28° to 45°.

The following is from the May, 1887, report of the "Minnesota Weather Service":

Verifications of weather signals for Minnesota were 73 per cent. for weather and 89 per cent. for temperature; for eastern Dakota, 75 per cent. for weather and 90 per cent. for temperature; for northern Iowa, 81 per cent. for weather and 85 per cent. for temperature.

The following is from the May, 1887, report of the "South Carolina Weather Service":

The percentage of verification of the weather and temperature predictions for the whole state was: for weather, 69.2 per cent.; for temperature, 86.0 per cent.

The following is from the May, 1887, report of the "Tennessee State Board of Health Bulletin":

The percentage of verification of the temperature and weather predictions during the month at Nashville and Clarksville were as follows: Nashville, temperature, 83.9 per cent.; weather, 77.4 per cent.; Clarksville, temperature, 93.3 per cent.; weather, 66.6 per cent.

#### ERRATA.

In the REVIEW for March, page 79, under "Monthly snow-falls," that for Yellow Springs, Ohio, given as 9.3 inches, should read 0.8 inch; and under "Depth of snow on ground at end of month," on same page and for same station, the depth given as 0.8 inch should not have been published; there was no snow on ground at the end of the month at Yellow Springs.

### STATE WEATHER SERVICES.

The following extracts are republished from the reports for May, 1887, of the directors of the various state weather services:

The "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The temperature during the month has been mild and beneficial to vegetable growth. No sudden and injurious changes have been reported from any station. The average temperature for the state was normal.

The rainfall for May was below the normal 1.53 inches. The distribution, however, has been so uniform and precipitations so frequent the condition of the crops has been very materially improved over that reported in the April bulletin. Farmers are very much encouraged with the outlook and, with the exception of the oat crop, anticipate a full yield from all plantings.

The spring months just closed furnish an average temperature of 64°, which is 1° below the normal. The total precipitation for the same period was 7.02 inches, falling below the normal 10.98 inches.

#### Summary.

Mean temperature, 73° 6'; highest temperature, 99°, at Roanoke, on the 9th; lowest temperature, 40°, at Gadsden, on the 1st; range of temperature, 59°; greatest monthly range of temperature, 53°, at Gadsden; least monthly range of temperature, 20°, at Moultrie; mean daily range, 17° 8'; greatest daily range of temperature, 52°, at Gadsden, on the 1st; least daily range of temperature, 1°, on the 25th, at Trinity.

Mean depth of rainfall, 2.85 inches; mean daily rainfall, 0.092 inch; greatest depth of monthly rainfall, 6.60 inches, at Marion; least depth of monthly rainfall, 0.91 inches, at Gadsden; greatest daily local rainfall, 2.65 inches, at Livingston, on the 26th.

Average number of days on which rain fell, 10; average number of cloudy days, 7; average number of fair days, 17; average number of clear days, 7.

Warmest day, 17th; coldest days, 1st and 6th.

Prevailing direction of wind, southwest.

The "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, of Springfield, director:

There have been but two spring months in the past thirteen years having a greater degree of heat than that of the past month, May of 1880, with a mean temperature of 68° 1, and May of 1881, with a mean of 69° 1, being these exceptions.

The mean temperature of May, 1887, 67° 4, was 4° 5 above the normal for the past thirteen years. The coolest May in that period being in 1882, with a mean of 58° 1.

The mean temperature of the northern division was 65° 2; of the central division, 67° 9, and of the southern division, 69° 9.

The departures above the normal were marked in each of the three divisions, and in but one of the counties reporting (Clay) was the mean temperature a trifle below the normal.

Temperature.—The maximum temperature, 98°, is the highest on record for the month, and the mean temperature was nearly five degrees above the May normal for thirteen years.

There has been a general deficiency of rainfall during the month, notably

so in the northern division, where the average for the past spring was over five inches below the spring average for the past ten years. The average rainfall for the central and southern divisions was less than one inch below the normal for May, and was well distributed, falling at opportune times. Thunder-storms were frequent, but few casualties from lightning were reported. Hail fell in certain sections, being reported quite heavy, but without damage to crops.

There were no violent wind or rain storms reported during the month.

Precipitation (*inches and hundredths*).—A great deficiency for the month is noted for the northern division. The average for the state, 2.94, was 1.24 below the May normal for the past ten years, but the rainfall for the central and southern divisions being only from 0.67 to 0.76 below their respective averages, it is apparent that the bulk of the deficiency noted above is due to the lack of rainfall in the northern division, where the average for the month, 1.77, was 2.09 below the May normal for the past ten years. The average amount in the central division, 3.84, was 0.67 below the May normal, and in the southern division, 3.44, was 0.76 below the normal for the month.

Rain fell on twenty days during May in the northern division, but the amount deposited was inappreciable nearly two-thirds of the time. Prior to the 21st there was barely appreciable rainfall. More moisture was deposited during the general thunder-storm of the 22d than the total for the remainder of the month.

The "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

The temperature was considerably above the normal, 4° 7 for the whole state, the greatest excess being 5° 4 and the least 3° 2. Though the temperature was unusually high, the range was unusually small; the average for the state was only 38°. The lowest recorded was 42°, while at one station, Angola, 100° was recorded, so that the extreme range was 58°.

The precipitation was below the normal, except at Vevay, where it was 0.54 inch above the average of twenty-one years, and Connersville, where it was 1.48 above the average of five years. On the whole the deficiency for the state was from 1 to 2 inches. There were, however, considerable heavy local rains, 2 inches being recorded at Marengo on the 23d, while at Princeton, on the 12th, 1.10 inches fell in twenty-five minutes.

The "Iowa Weather Service," Dr. Gustavus Hiurichs, Iowa City, director:

May, 1887, was very warm and dry, fair to fine weather, and southerly winds greatly prevailing.

The mean temperature of the air was six degrees above normal. During the past seventeen years May has but three times been as warm or warmer, namely, in 1881, 1880, and 1871. During the thirty-two years ending 1870, but twice was it as warm, namely, in 1869 and 1870. In forty-nine years May has thus but six times been as warm as it was this year, and half of this number has occurred during the past eight years.

The first twenty days of May averaged eight degrees above normal; the last

ten days averaged only two degrees above normal. Days exceeding their normal temperature by over ten degrees were the 1st, the nine days from the 8th to the 16th, and the three days from the 20th to the 22d. On only one day (the 30th) did the temperature fall ten degrees below normal.

At the central station we had fourteen clear days, the greatest number ever recorded, and nearly double the normal number. Only four days were cloudy days. The mean cloudiness was only thirty-four per cent., while normally it is fifty per cent. for May.

The air was remarkably dry on many days. The lowest relative humidity was twenty-four per cent., on the 24th at 2 p. m.

The rainfall at the central station was but fifty-five per cent. of the normal. Since 1848 it has been as little or somewhat less eight times before, namely, in 1881, 1880, 1875, 1874, 1871, 1866, 1860, and 1855, or in all, nine times in forty years.

In the state, a belt along the Missouri River, southern and southeastern Iowa received the most rain, namely, two inches, and at a few points as much as three inches. This is about one-half the normal rainfall. Northern Iowa, from Winnebago and Howard counties down to Polk and Iowa counties, received generally only about one-half an inch of rain, being only from one-fourth to one-eighth the normal amount. In the northern counties this small amount of rain did not fall till at the close of the month, when good rains also first favored northeastern Iowa. At Concord, Hancock Co., no measurable rain fell during the entire month. From this northern and central region of lowest rainfall to the west, south, and southeast, the rainfall gradually increased to the amount already specified.

It thus appears that only the northern and central portions of Iowa specified have suffered from drought. This affects small grain, hay, and grass only, as corn can easily make up when rain comes in June.

The only days on which rain was nearly general for the state were the 1st, 13th, 21st, 29th, and 31st, of which, all but the last were also noted by thunderstorms. In all, rain fell on nineteen days of the month in Iowa, and yet the month was very dry, most of these rains being very local and very light.

No destructive storms occurred. Lightning killed several persons and some stock, also destroyed some buildings. Hail did some damage in Emmett and Bremer counties (1st), also near Sioux City (26th), and in Johnson county (29th). The only really heavy rain storm occurred in Henry county on the afternoon of the 14th, giving two inches and a half of rain at Mount Pleasant.

No damaging frosts occurred this month. Light hoar frosts were seen in the west on the 3d and 4th, and in the north on the 18th. Fog on the 6th in northern-central Iowa, and on the 7th in middle-eastern Iowa.

The northern lights were noted on the 18th at four stations, and on the 24th at two stations.

On the whole, the season is greatly ahead in temperature and much behind in rainfall; but as we approach the normally abundant June rains, and as rain in May has been far from uncommon, no fears are justifiable.

The "Kansas Weather Service," Prof. J. T. Lovewell, Topeka, director:

The temperature has ranged about 2°.0 above the May average over the state. Although the rainfall has been deficient over the middle and eastern divisions yet it has been so well distributed throughout the month as to have the corn in excellent condition.

The "Michigan Crop Report" (the state weather service is in charge of N. B. Conger, Sergeant, Signal Corps, at Lansing):

*Temperature.*—The mean temperature for this month, 61°.4, is 8°.2 above the normal. The normal for the central and southern counties is 56°.2, while the mean for this month has been 6°.7 above the normal.

High temperatures were recorded generally in the state on the 21st, in most cases above 90°. The temperature after the 21st was lowered by the general rains which occurred from the 23d to the 31st.

*Precipitation.*—The mean rainfall for the month, 2.40 inches, is 0.77 inch below the normal, and the maximum portion of this fell on the last nine days of the month. The average precipitation for the state from the 1st to the 22d, inclusive, was 0.63 inch, so that the average rainfall for the remaining nine days was 1.77 inches. The period from the 1st to the 22d covers the dry season, up to the date on which general rains fell throughout the state.

The counties of Berrien, Cass, Clinton, Gratiot, Ingham, and Kalamazoo record considerable rain on the 17th, but these are the only counties that had sufficient rain during this period. Oceana county reports record no rainfall until the 23d.

#### Summary.

Mean monthly temperature, 61°.4; highest temperature, 97°.1, on the 9th, at Grayling; lowest temperature, 28°, on the 4th, at Grayling, and on the 18th, at Gaylord; monthly range of temperature, 69°.1; greatest range of temperature, 69°.1, at Grayling; least range, 33°.0, at Benton Harbor.

Average precipitation, 2.40 inches; average number of clear days, 14.8; average number of fair days, 11.7; average number of cloudy days, 4.5; average number of rainy days, 8.4.

Prevailing direction of the wind, southwest; maximum velocity of the wind and direction, thirty-nine miles, south, at Grand Haven.

The "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The dominant features of the month were an abnormally high temperature, and a deficiency of precipitation in the southern counties. For the first week

of the month the temperature and rainfall were slightly in excess; for the second and third weeks the temperature was above and the precipitation below the average; from the 22d to 31st, both the temperature and precipitation was slightly deficient. By May 7th the wheat was nearly all sown in Minnesota and Dakota and under conditions more favorable than for several years. The ground was in excellent condition before seeding was begun, as the snow, which disappeared slowly, sank into the ground and timely rains which followed assisted in keeping it damp. At the close of the month the conditions of the soil and climate were generally favorable for the crops.

*Temperature.*—May, this year, takes precedence over nearly all other terminal spring months, of which there is a record in this state, for a high mean and maximum temperature; in 1881, the mean at a few stations equaling that of this year. Some of the very high maxima temperatures, and which occurred on the 10th, were: Sherburne and Saint Vincent, 96°.0; Moorhead, 95°.5; Spring Valley, 95°.0; Grand Forks, 93°.0. Some of the minima, and which occurred on the 17th, were: Saint Vincent, 24°.8; Moorhead, 25°.1; Grand Forks, 26°.0. It is notable that both the maxima and minima temperatures were reported from the northwestern portion of the state. The low temperatures on the 2d, 3d, 16th, and 17th caused killing frosts in some localities, but the damage to crops was hardly appreciable. The mean temperature for the state is 61°.7, which is 2°.8 above that of the corresponding month of 1886, and 6°.9 above that of 1885. The mean is abnormally high at all stations where records have been kept for a number of years, excepting at Duluth, where it is normal. The departures amount to about five degrees in the western and southern portions of the state. The monthly range of temperature for the state is 71°.2, which is the same as that for Saint Vincent; the greatest ranges were reported from the Red River Valley, while the least were in the northeastern counties near Lake Superior; the least range was 45°.3 at Duluth.

*Precipitation (in inches).*—The average for the state was 1.78, being 0.27 above that of May, 1886. There was a decided deficiency, except in the northern portion of the state, where there was an excess of about an inch. At Saint Paul the rainfall was 1.6 below the average, while at La Crosse it was 2.5 below, the amount which fell at the latter station being less than that for any corresponding month since the station was established in 1873. Some of the lowest rainfalls reported were La Crosse, Winona, and Litchfield, 0.50; Albert Lea, 0.71; Red Wing, 0.99. Some of the heaviest reported were: Duluth, 4.93; Pokegama Falls, 3.79; Saint Vincent, 3.57; Grand Forks and Moorhead, 2.57. The dates of general precipitation were the 1st, 2d, 13th, 14th, 21st to 24th (inclusive), and the 29th to 31st. Stations reporting over an inch of rainfall during any twenty-four hours, with the amounts, were: Duluth, 1.35, 1st, and 1.93, 2d; Pokegama Falls, 1.02, 24th; Rolling Green, 1.40, 13th; Grand Forks, 1.24, 29th.

The prevailing direction of the wind, south.

The "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

#### Summary.

Mean temperature, 74°.0; highest temperature, 95°.0, at Jackson, on the 13th, and Brookhaven on the 11th; lowest, 30°.0, at Lake, on the 5th; range of temperature, 65°.0.

Mean depth of rainfall, 3.05 inches; greatest monthly rainfall, 8.75 inches, at Okolona; least monthly rainfall, 0.27 inch, at Port Gibson. Average number of days on which rain fell, 7.6.

The "Missouri Weather Service," Prof. Francis E. Nipher, of Washington University, Saint Louis, director:

At the central station (Saint Louis) the temperature of May has been 70°.6, which is 4°.3 above the normal. The highest temperature, 86°.5, on the 1st, and the lowest was 52°.1, on the 5th. The rainfall, 4.75, is the normal rainfall for May.

The highest temperatures reported from the state were 95°.0, at Mound City; 93°.0, at Miami and Pro Tem; 92°.0, at Kirksville, Louisiana, and Sedalia; and 91°.0, at Fayette and Oregon.

The greatest amount of rain fell in the central, southern, and eastern parts of the state, where the fall was from 4.00 to over 5.00 inches. The highest fall occurred at Pro Tem, it being over 8.00 inches, and the lowest at Kirksville, 1.17 inches. At Cairo the fall was only 1.37 inches.

The "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

*Precipitation.*—The distribution of rainfall for the month is very equal. Two regions, the extreme northwestern part of this state, and another in the valley of the Big Blue have received over five inches, while the central and northeastern portions have received very little, one station reporting but four-tenths of an inch; its distribution throughout the month has also been very poor, most of it coming in one or two heavy rains, so that the number of rainy days is less than usual.

The average rain for the different sections of the state for May, 1887, is as follows: northeast section (four stations), 1.09 inches; north-middle (two stations), 1.37 inches; west (one station), 5.87 inches; south-middle (four stations), 1.41 inches; southeast (covering essentially what has heretofore been the "whole state" as far as reporting), 3.04 inches; state average, by sections, 2.56 inches.

*Temperature.*—The average temperature for southeastern Nebraska is 8°.4 below the normal, and both the highest and lowest temperatures of the month have exceeded those of May of the previous nine years.

**Weather signals.**—The distribution of weather predictions, as explained in our last report, is being regularly made from this office to all accessible points desiring them. Thirty-nine stations are now receiving the daily 10 a. m. predictions, and a considerable number of them are displaying flags. The others are posting the bulletins in the post-office. Very general satisfaction is expressed with the system.

The "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

Reports for the month were received from one hundred and forty-nine observers.

The month was unusually dry and warm. The abnormal warmth at several long-record stations is remarkable. The deficiency in precipitation reverses the excess of the previous six months. The dry weather of the first three weeks was followed by sufficient rain to prevent threatened injury to the growing crops, and at the close of the month the fields and gardens were generally in fine condition. The barometric variations were few and slight.

The weather of the month may be considered in four periods: First, fair, warming days from 1st to the 5th; second, light showers on 6th, 7th, and 8th; third, a long dry period from the 9th to the 23d, relieved only by light showers on the 10th and 18th, in the north; fourth, seven days of cloudy and rainy weather from the 24th to 30th, with a fair day or two to close the month.

The "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

The most important feature of the weather during May was the drought. In some counties of the state growing crops suffered and great anxiety prevailed. No storm-centre crossed the borders of the state. The temperature ran high, and, compared with previous records extending over a period of years, the mean average at eleven stations, Atlantic City, Dover, Lambertville, Moorestown, New Brunswick, New York City, Paterson, Philadelphia, Princeton, Somerville, and South Orange, showed an excess amounting to 3°.4.

The rainfall for the month was abnormally low, the least in years, and insignificant when compared with the precipitation of May, 1886. The little that did fall evaporated almost as fast as deposited. Heavy fogs and dews on the coast line were quite frequent, and some observers attribute the saving of their crops to the moisture received in this way alone.

The "North Carolina Weather Service," Dr. Charles W. Dabney, jr., of Raleigh, director:

**Atmospheric pressure (in inches).**—Mean for May, 1887, 30.01; normal for May, 30.03; deviation from the normal, +.02; highest, 30.42, at Chapel Hill, on the 15th; lowest, 29.53, at Hatteras, on the 27th.

**Temperature (in degrees).**—Mean for May, 1887, 69.9; normal for May, 66.9; deviation from the normal, +3.0; highest, 95.0, at Maxton, on the 18th; lowest, 32.0, at Salem, on the 6th; highest on record for May, 98.0, at Norfolk, in 1880; lowest on record for May, 37.0, at Lynchburg, in 1876. Average morning temperature, 63.6; normal, 63.6; deviation from the normal, 0.0. Average afternoon temperature, 78.8; normal, 73.3; deviation from the normal, +5.5. Average night temperature, 67.6; normal, 64.5; deviation from the normal, +3.1. Mean of maximum, 89.1; normal mean of maximum, 93.2; deviation from the normal, +4.1. Mean of minimum, 47.6; normal mean of minimum, 40.2; deviation from normal, +7.4. Greatest daily range, 46.0, at Maxton, on 2d; greatest daily range, 33.3, monthly average; least daily range, 4.3, at Raleigh, on 31st; least daily range, 8.0, monthly average; mean daily range, 20.5; greatest monthly range, 59.5, at Salem; least monthly range, 22.9, at Hatteras; mean monthly range, 41.4; absolute range, 63.0.

Warmest days, 8°.0 above normal, on the 4th and 18th; coldest day, 5°.0 below normal, on the 15th; warmest localities, 3.0 above normal, at Lynchburg, Maxton, Chapel Hill, and Knoxville, Tenn.; coldest locality, 2°.0 below normal, at Reidsville, N. C. Normal readings, 9.1 per cent.; abnormally high readings, 70.5 per cent.; abnormally low readings, 20.4 per cent.

**Precipitation (in inches).**—Average for May, 1887, 4.55; normal for May, 3.76; deviation from the normal, +0.79; daily average, 0.15; greatest monthly rainfall, 8.07, at Weldon; greatest daily rainfall, 6.03, at Weldon, on the 10th.

The "Ohio Meteorological Bureau," Prof. B. F. Thomas, of the Ohio State University, Columbus, president:

The mean temperature was 66°.0. This is our highest May mean, and is 4°.2 above the average and 5°.3 above the normal.

The highest temperature was 97°, our highest for May, and the lowest was 38°. On each of the four preceding years covered by our records, the May minimum was 32°, or lower. The mean daily temperature range was 22°.8, which is also the May average.

The number of clear days was greater than usual.

The mean rainfall was only 2.87 inches. The mean for the middle section of the state was 3.35 inches; for the southern section, 2.87, and for the northern section, 2.79. The greatest mean rainfall occurred at Quaker City, 5.7 inches, and the least, 1.28 inches, at Waverly.

#### Summary.

Mean temperature, 66°.0; highest temperature, 97°.0, on the 21st, at Pomeroy; lowest temperature, 38°.0, on the 1st, at Youngstown, on the 19th, at Paulding; range of temperature, 59°.0; mean daily range of temperature, 22°.8; greatest daily range of temperature, 46°.0, on the 20th, at Paulding; least daily range of temperature, 4°.5, on the 6th, at Portsmouth.

Average number of clear days, 12.6; average number of fair days, 11.7; average number of cloudy days, 6.7; average number of rain-days, 12.0.

Greatest number of days on which rain fell, 17, at Clarksville, Quaker City, Waynesville; least number, 6, at Gambier, Hanging Rock.

Mean monthly rainfall, 2.87 inches; average daily rainfall, .092 inch.

Prevailing direction of wind, northeast.

The "South Carolina Weather Service," Hon. A. P. Butler, Commissioner of Agriculture for South Carolina, director:

The month has presented no marked meteorological feature. The mean temperature has been about normal. At Charleston the mean temperature was 72°.7, which is also the mean for the last sixteen years.

On the coast the rainfall has been about the average, but in the middle and upper portions of the state it has been less than the average.

As a whole the month has been very favorable for the growing crops. The nights were rather cool for cotton, but this was largely counteracted by the warm sunshine during the days. The rainfall, though deficient, was generally well distributed, and crops were much benefited by the copious rains which occurred at the close of the month.

#### Summary.

Mean temperature, 72°.5; highest temperature, 97°, at Chester, on the 18th; lowest temperature, 41°, at Chester, on the 1st; range of temperature, 56°; greatest daily range of temperature, 50°, at Chester, on the 1st; least daily range of temperature, 6°, at Newberry, on the 20th and 30th.

Mean depth of rainfall, 3.17 inches; greatest daily rainfall, 2.30 inches, at Charleston, on the 22d. Heavy rains occurred in the upper and middle counties on the 31st. In the lower counties the heaviest rains of the month occurred on the 22d.

Rainfall measurements exceeding one inch in twenty-four hours were reported as follows: 6th, Saint Matthew's, Orangeburg Co., 1.33 inches; 8th, Belfast, Barnwell Co., 1.30 inches; 12th, Greenwood, Abbeville Co., 1.25 inches; 12-13th, Columbia, Richland Co., 1.49 inches; 14th, Branchville, Orangeburg Co., 1.55 inches, and Yemassee, Beaufort Co., 1.32 inches; 22d, Jacksonborough, Colleton Co., 1.19 inches; Yemassee, Beaufort Co., 1.02 inches; Charleston, Charleston Co., 2.30 inches; 23d, Branchville, Orangeburg Co., 1.02 inches; Florence, Darlington Co., 1.83 inches; 31st, Abbeville, Abbeville Co., 1.08 inches; Anderson, Anderson Co., 1.00 inch; Brewer Mines, Chesterfield Co., 1.45 inches; Newberry, Newberry Co., 1.39 inches.

Least daily rainfall, inappreciable, at several stations, on the 19th and 20th.

Average number of rainy days, 10.2.

The "Tennessee State Board of Health Bulletin," under the direction of J. D. Plunkett, M. D., President of the State Board of Health (the weather report is prepared by H. C. Bate, Director of the State Meteorological Service):

The meteorological conditions for May show few departures from the normal.

The mean temperature was 70°, slightly above the average of the five years past. The highest temperature was 93°, recorded on the 9th, and was 1° below the maximum for May in 1885, which was the highest for the corresponding period in five years. The lowest temperature was 44°, recorded on the 28th, and was the highest minimum for May in the five years, the next highest being 39°, in 1884. The monthly range of temperature was the least for the period above mentioned.

The mean precipitation for the month was 3.53 inches, slightly below the average for May in the past five years, the greatest amount being 4.42 inches, in 1886. Of this amount, the eastern division received by far the largest portion, having an average of nearly five inches, the middle division receiving an average of about three and a quarter inches, while the western division received less than two and a half inches.

The rains were numerous but generally light, and many of them local. Those of the 5th, 7th, 10th, 13th, 25th, 26th, 30th, and 31st were general rains. Many of the rains were accompanied with severe electrical disturbances, and some with hail and wind, but no great amount of damage was reported. The days of the greatest rainfall were the 5th, 6th, 25th, 30th, and 31st, the last named having the greatest fall during the month. Notwithstanding the proportionately low average of rainfall, there were only three or four days reported free from a measurable quantity of rain in any part of the state. The greatest rainfall was 6.57 inches, reported at Chattanooga, and the least was only 0.76 inch, reported at Beech Grove. The greatest local daily rainfall was 2.50 inches, reported on the 31st at Grief; the next greatest was 2.49 inches, on the 25th, at Hurricane Switch. There were other heavy local daily rainfalls during the month. No frosts were reported during the month, quite an unusual thing, as the first decade is usually marked by severe frosts in some portions of the state. This, together with the heavy dews supplementing the rains, and a fair proportion of sunshine, and the absence of any very unfavorable conditions, rendered the month quite favorable for the growing crops.

#### Summary.

Mean temperature, 70°.0; highest temperature, 93°, on the 9th, at Dyersburg; lowest temperature, 44°, on the 28th, at Farmingdale; range of temperature, 49°; mean monthly range of temperature, 34°.8; greatest monthly range of temperature, 43°, at Farmingdale; least monthly range of temperature, 28°, at Careyville and Florence Station; mean daily range of temperature, 18°.2; greatest daily range of temperature, 36°, on the 1st, at Fostoria, and on the 14th, at Austin; least daily range of temperature, 4°, on the 18th, at Beech Grove and Covington, on the 25th, at Vernon and on the 26th, at

Fostoria; mean of maximum temperatures, 88°.7; mean of minimum temperatures, 53°.9.

Average number of clear days, 12.3; average number of fair days, 12.3; average number of cloudy days, 6.4; average number of days on which rain fell, 11.6.

Mean depth of rainfall, 3.53 inches; mean daily rainfall, 0.114 inch; day of greatest rainfall, 31st.

Days without rainfall, 1st, 15th, 28th.

Warmest day, 9th; coldest day, 28th.

Prevailing winds, south and southwest.

### NOTES AND EXTRACTS.

#### FOG PREDICTIONS FOR THE BANKS OF NEWFOUNDLAND.

[By Sergeant E. B. GARRIOTT, Signal Corps.]

This subject was briefly discussed in the MONTHLY WEATHER REVIEW of March and April, 1887. Shipmasters have generally responded to requests for special reports relative to fog-banks, and data received has admitted of fuller and more satisfactory investigations in connection with these phenomena.

The atmospheric conditions requisite to the development of fog are too well known to require discussion; suffice it to say that these conditions are more marked and more frequently exist over the Banks of Newfoundland than in any other locality within the usual routes of travel. The prevailing winds in this region are westerly, and the differences in temperature between air drawn from the continent and that which overlies the ice-fields and the cold Arctic currents are not, as a rule, sufficiently great to cause a large precipitation of fog-atoms. It is therefore evident that the denser fog formations are due to meteorological conditions whereby greater ranges in air temperatures are occasioned. The element of cold air is constant in this region and the opposing element of warm air is ever present over the ocean to the southward and over the Gulf Stream which flows from the southwestward over the southern edge of the Banks. The causes which influence the flow of warm air from the southward and from over the Gulf Stream are necessarily due to meteorological conditions whereby the prevailing westerly winds are diverted to the southern or eastern quadrants. The causes whereby these conditions are developed are traceable to cyclonic areas which pass eastward over the ocean from the continent. All reports of fog encountered in the vicinity of the Banks verify these conclusions, and it now remains to determine how this knowledge can best be utilized for the benefit of shipmasters.

For purposes of fog predictions it is advisable to consider only the storms which leave the American coast north of the thirty-fifth parallel, both by reason of the fact that they generally pass over, or in close proximity to, the Banks of Newfoundland, and on account of the facilities offered by telegraphic land reports for foreseeing their probable course from the interior or western

portion of the continent. Following the appearance of a storm-area in the central valleys of North America, a minimum period of about three days is commonly allowed for its advance to the Maritime Provinces, at the expiration of which time the conditions favorable for fog would commence to develop over the Banks, and would continue about two days, or until the passage of the depression had caused the wind to again shift to westerly. This calculation allows a period of at least five days between the appearance of a cyclonic area over the interior of the continent and the time of greatest probable fog density over the Banks as resulting from its eastward movement. With this margin of time allowed forecasts of great interest and value could be made for the benefit of the shipping interests. Outward bound steamers could be forewarned of the probable presence of fog over the Banks in season to anticipate its presence on arrival in that locality, and vessels about to sail from British ports could have seasonable warning by cable. In cases of abnormal and unexpected rates of progression of storm-areas, or of rates of speed, on the part of vessels, insufficient to reach these longitudes in the time prescribed, a knowledge by shipmasters of the laws governing the circulation of winds within areas of low barometric pressure, and of the fact that with a shift of wind to the northwest quadrant, following the passage of a storm-centre, the fog-banks would dissipate, would enable them to determine, upon approaching the Banks, whether the anticipated conditions had developed or disappeared. If easterly or southerly winds and falling barometer were noted, it would indicate that the centre of the low barometric area was still to the westward, and fog might be expected; if, on the contrary, the wind had commenced to shift to westerly with steadily rising barometer, it would show that the storm-centre had passed to the eastward of the Banks, and an early disappearance of fog in that region might be calculated upon.

This subject is of vital importance to shipmasters, and will be pursued, not only in connection with the fogs peculiar to the Banks of Newfoundland, but also as relates to those which develop along the American coast in more southern latitudes.